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#### How to cite:

Kukulska-Hulme, Agnes (1998). The Concept Navigator: A Web-Based Concept Tracking Glossary Tool. In: Teleteaching '98 - Distance Learning, Training and Education (Davies, Gordon ed.), Proceedings of the XV IFIP World Computer Congress, Österreichische Computer Gesellschaft (Austrian Computer Society) on behalf of the International Federation for Information Processing, Vienna, Austria, pp. 607–614.

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# THE CONCEPT NAVIGATOR: A WEB-BASED CONCEPT TRACKING GLOSSARY TOOL

Agnes Kukulska-Hulme

***Abstract:** The Concept Navigator was first planned during the development of a new first-year undergraduate introductory computing course in the Maths and Computing Faculty of the Open University. The creation of this course prompted a discussion about the function and potential of glossaries in giving a coherent overview of the terms and concepts of a subject area. The Web-based Concept Navigator glossary tool was conceived as a generic tool allowing course authors and learners to engage easily in a process of "concept tracking": getting to grips with terms and concepts, checking how they have been used in course materials, and being able to locate them at a later date. It is capable of tracking each concept (represented by one or more terms) as it develops and sometimes changes meaning within a set of texts. It makes it possible to create glossary entries very simply, and dynamically generates Web pages with three types of glossary structure: an alphabetical listing, a conceptual glossary, and the concept navigator proper.*

## 1. Introduction

There is much current interest in the design of course materials which are to be accessed by learners over the World Wide Web [1, 2]. Some of the key pedagogical issues are how to take advantage of the opportunities for new ways of interacting with the materials (as well as with tutors and other students), how to provide effective orientation mechanisms that are appropriate to the medium, and how to assist learners in finding a meaningful route through course materials which have been designed with flexible learning in mind.

In distance education, reliable and effective ways of dealing with interaction, orientation and navigation have been evolved over time in paper-based modes of delivery. Interaction with learning materials might be encouraged through activities, reflective questions or self-assessment. Orientation and navigation within study texts is provided through text organisers such as tables of contents, overview charts, summaries. Along with indexes, these are typical access points to information in the text. Glossaries might also be provided, with the expectation that they might be used for clarification or revision.

The drawback with these mechanisms is that they do not help learners who want to track the development of particular themes or concepts in a course of study. Nor do they help learners to see how a term (or set of terms) has been used at various points in the materials, so that they themselves can use the terms appropriately. The text organisers contain some distilled elements. They might represent the end points in an author's thinking process, the points of convergence of a number of threads of argument in a text, or perhaps a reiteration of some problems or issues. Glossaries are usually collections of technical terms, capturing and "freezing" the meanings of terms for their

readers, with very limited scope for examples of usage. Index terms are not explicitly related to those in glossaries.

In fact, glossaries and indexes tend to be added to course materials at the very end of the process of writing. There is no possibility of checking easily whether a term has been used consistently, or how its meaning has changed. Computer assistance in terms of searching and indexing is only partially helpful in this respect. What can be seen here is the need for an overall framework for tracking terms and concepts, which could be used to meet the needs of authors of course materials, as well as a range of typical learning and assessment needs, such as clarification, consolidation, review, revision, writing.

## **2. Conceptual learning at a distance**

The Web-based *Concept Navigator* was conceived as a generic glossary tool which would allow course authors and learners to engage easily in a process of "concept tracking". It therefore addresses a fundamental problem of learning, which is also one that authors must live with - getting to grips with terms and concepts, checking how they are used, and being able to locate them at a later date. The project takes into account previous research and development work by Bob Zimmer, Mark Woodman, and Gordon Davies at the Open University on a relational glossary structure [3, 4], which proved to be a desirable approach to glossary development, but requiring a very disciplined attitude on the part of authors. Other related work on concept systems in OU course materials includes Alpay [5], Smee [6], and Heap [7]. The present project has received funding from the Office for Technology Development.

The Concept Navigator was first planned during the development of a new first-year undergraduate introductory computing course called "Computing: An Object-oriented Approach" in the Maths and Computing Faculty of the Open University. This distance learning course is being presented for the first time this year (1998). It uses a mix of learning media, including software, printed materials, CD-ROMs, conferencing, WWW, e-mail and television programmes; an Interactive Course Map has been developed to help students find their way around these different media [8]. The course materials state that students are expected to learn a very substantial number of new terms, so supporting them in this is important. A number of self-administered questions in the course materials focus on the meanings and usage of terms.

The creation of this course prompted a discussion about the function and potential of glossaries in giving a coherent overview of the terms and concepts of a subject area. The main function of a traditional glossary is to list and explain specialized terms. However, a glossary can be designed so that it helps learners to build their understanding of a subject, find their way around a set of course

materials, and even to express themselves in a specialized language. A glossary is often associated with a text, but not necessarily. The scope is not self-evident, and has to be made clear to learners. A glossary might encompass one of the following, for instance:

- some of the terms used in a collection of texts
- some of the terms used in course materials located on various media
- terms commonly used in a subject field or discipline
- some of the terms used in course materials, with additional terms from the subject field
- only a small number of key terms

Each glossary entry might contain:

- ⇒ formal definitions, and/ or more informal explanations
- ⇒ cross-references within the glossary, used specifically for terms that are often confused
- ⇒ references to where the term appears in course materials
- ⇒ related terms, which may not figure as entries in the glossary
- ⇒ phrases and examples of usage, especially typical usage, to build learners' confidence in using a term in their own writing

It emerged from the above that learners should not be limited to asking the question: "What does this term mean?". Examples of other possible questions are:

*What's the term used for such-and-such?*

Learners sometimes want to look for words they know or remember only vaguely, and for meanings rather than just specialized terms, which can benefit their learning.

*What's the difference between these concepts?*

Learners may wish to compare related concepts by comparing explanations where the same process or object etc. is mentioned.

*Where did I see this before?*

This concerns looking up a term which was present in an earlier part of the course but which did not register with the learner at the time (because sections were skipped, or done in a different order, or through lack of attention). Learners then become aware of gaps in their knowledge, and the need to go over certain materials.

*Will I be learning about this?*

Looking ahead to what else will be covered in the course can be made easier if learners do not have to rely on chapter headings.

One of the most important observations made was that in order to help learners answer these sorts of questions, it would be good to give them ready access to specific locations in the course materials where a particular concept was mentioned, so that they could see it in context. It also became clear that one could attempt to trace the development of a concept or term as it was used in various parts of the course materials, e.g. *behaviour*:

behaviour of a system Chap 1  
 behaviour of an object Chap 6  
 state-dependent behaviour Chap 6  
 behaviour in response to a message Chap 6  
 simple behaviours Chap 9  
 complex behaviour Chap 9  
 cooperative behaviour between objects Chap 9

As occurrences of terms were identified, questions about the differences between similar terms would naturally emerge, for example:

- What is the relationship between an *action*, a *scenario*, an *event*, and *behaviour*?
- Are *constituents* different to *components*?
  - What about *constituent components* ?
  - How does an *element* relate to a *constituent* and a *component*?
- Are the terms *priority* and *precedence* used differently?
- Are *answer*, *reply*, and *response* used interchangeably?
  - Is *answer* the main technical term in this subject field?
- Is *cooperative behaviour* exactly the same as *collaborative behaviour*?

This in turn would point to sets of terms which might be grouped under a more global concept. For example, an “Answers” concept could be used to bring together the terms *reply*, *response*, and several other more complex ones, e.g. *message answer*, *default message answer*, *message answer expression*.

### 3. The Concept Navigator

In response to the wish to give students access to information about the use of terms, the relationships between them, and especially the development of meanings within the course materials, the Concept Navigator was created. It is capable of tracking each concept (represented by one or more terms) as it develops and sometimes changes meaning within a set of course materials. It makes it possible to create glossary entries very simply. The electronic text of course materials (which can include scripts of multimedia courseware) is searched to locate occurrences of key concepts identified by course authors, with their corresponding terms. This starts the process of “tracking the concept”. The glossary creator - typically an academic course team member or an editor - selects a number of “contexts” (extracts of course materials) for each glossary entry. In this way, for each term, a picture is built up of the development of the concept represented by a set of terms. Students are then able to navigate between parts of course materials by following the tracks laid down by the glossary creator. They can see what has been said about each term or concept in different parts of the course. This process should assist them in making connections between parts of the course, building up and revising their understanding. It will show them whether the meaning of a term has changed, which sometimes happens when teaching materials simplify concepts initially to make them more accessible, and later introduce more complexity or new shades of meaning.



### 3.1. The author perspective: concept and context marking

The Concept Navigator consists of two modules: an editing and a presentation tool. From the course author's point of view, the editing tool is important. It is used first of all to mark up the electronic text of the course materials, so as to show occurrences of any terms which the author wishes to highlight for the learner (Fig. 1). Each highlighted term is automatically entered into a database, and the author assigns it to a "concept grouping". A number of "contexts", or extracts of course materials, can now be added to the entry for that term (Fig. 2). Each context is then associated with a "section heading", which is a reference to a position in the course materials. Authors can create any number of section headings, using existing headings in the course materials, or making some additional ones.

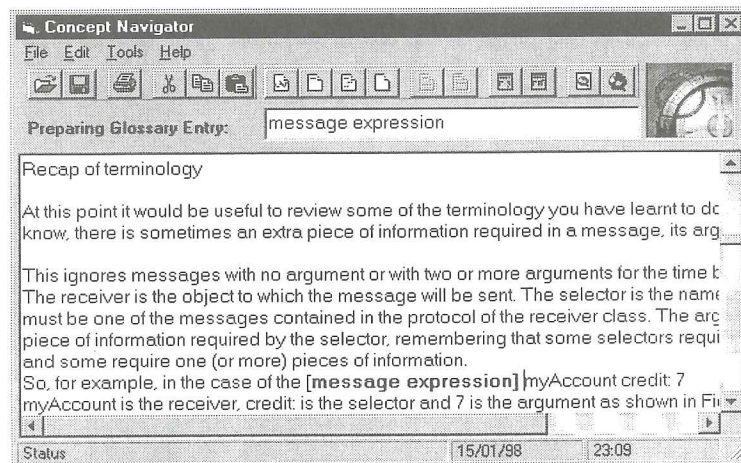


Fig. 1

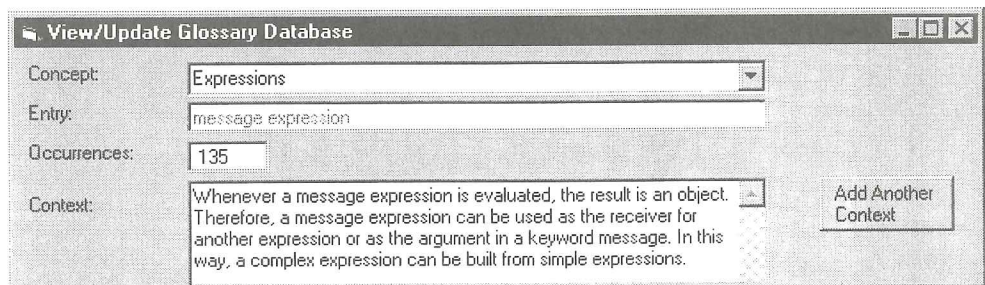


Fig. 2

When the text has been marked up and the database of glossary entries has been created, the author selects a function which converts all the data to HTML and dynamically creates the Web-based Concept Navigator for the learners.

### 3.2. The learner perspective: the development of a concept

From a learner's point of view, the Concept Navigator offers several ways of viewing terms and concepts and the contexts in which they are embedded. There is an *alphabetical listing* of terms, a *conceptual glossary* (Fig. 3), which groups terms under the concepts they have been assigned to (a term can belong to more than one concept), and finally the *concept navigator* proper, which shows the chronological development of a concept through the occurrences of terms in course materials (Fig. 4). The learner can click on any term in the left hand frame, to see the short context (extract of course materials) from which it was derived, and can use the right hand window to locate the corresponding section in the course materials, to see the term in its original setting (Fig. 5). One can then move on to the next occurrence of the term in the left-hand frame, creating the opportunity for a comparison of the way a term has been used in two places in the course materials - and how its meaning and use has been developed.

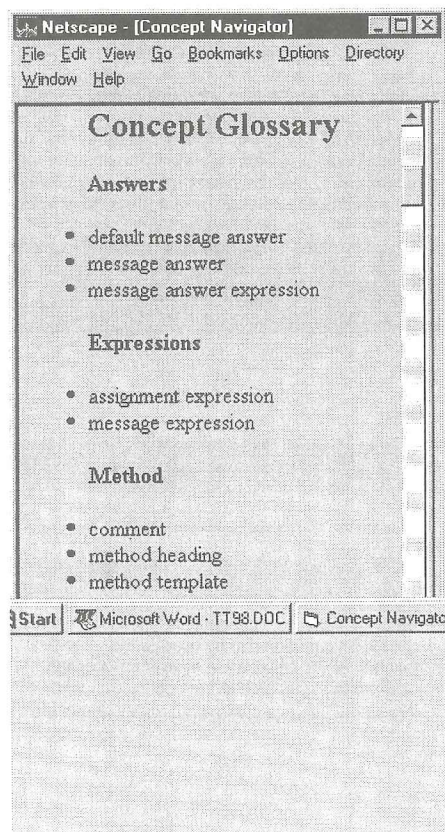


Fig. 3



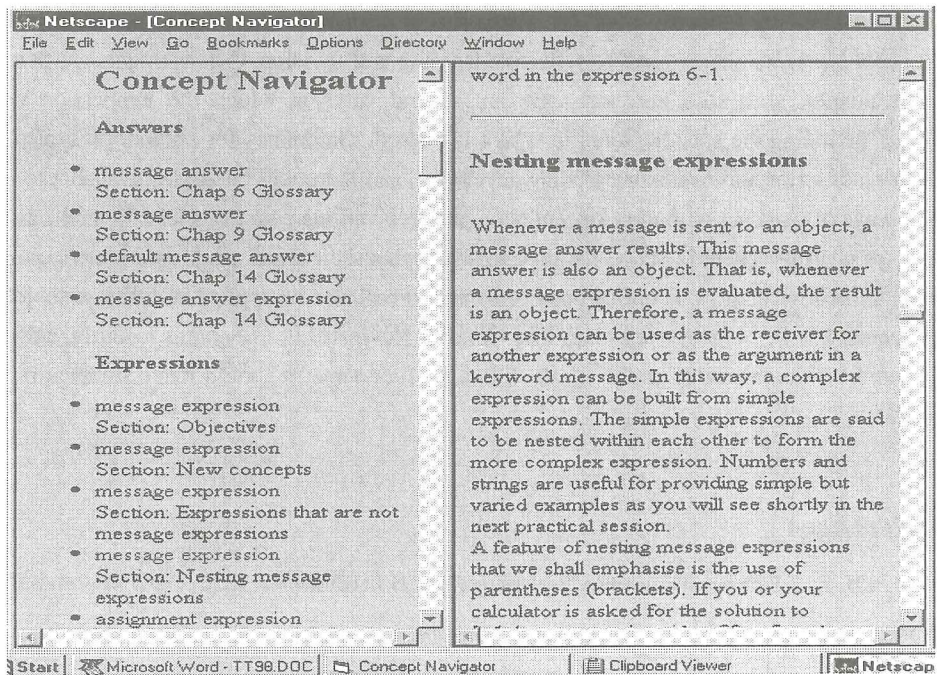


Fig. 4

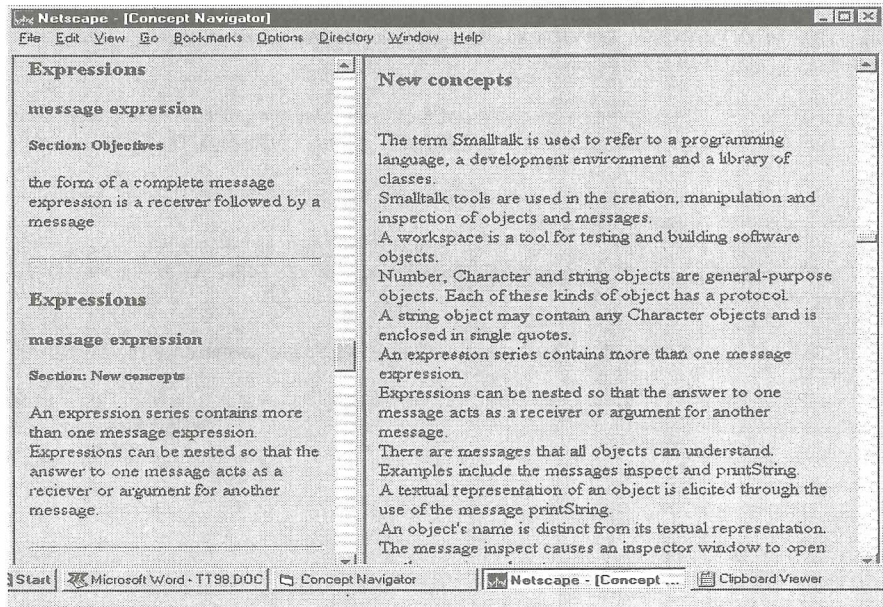


Fig. 5



#### 4. Future work and conclusions

The Concept Navigator lends itself to reflective learning and revision. Arrangements are being made for an evaluation with students, and there are several ways in which the application could be developed, including the specific ways in which it is used. Guidelines for authors on typical criteria for selection of terms and contexts are being developed, and there will be advice available to students on good ways of working with the Concept Navigator for various ends, e.g. clarification, discovery, revision, or writing. There is scope for investigating whether it could work as a more general Web site orientation device, or as an online book organiser. It will also be applied in different subject areas, one of which will be language learning. The Concept Navigator is a learning resource and support mechanism for either a part of or the whole duration of a course; it should make students more self-reliant.

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